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Abstract

THE AQUEOUS HOMOGENEOUS SUSPENSION REACTOR PROJECT

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This paper gives a survey of the present status of the development of the Aqueous Homogeneous Suspension Reactor Project. This project aims at investigating the application of aqueous oxide suspensions as reactor fuel.

Some features of the mean experimental facility, the Kema Suspension Test Reactor (KSTR) which is under construction, are presented. The design of this test reactor is based on results of the research and development program carried out during the last few years. Typical results in connection with the application of aqueous suspension fuels are reported.

The experimental work has confirmed the important role of colloid chemical phenomena in the behaviour of suspensions. Since this requires colloid chemical investigations at elevated temperatures (up to 250°C) a new method has been developed for this purpose. Results obtained with this method are given.

The predominant influence of the colloid chemical conditions was clearly revealed by the results obtained with a low temperature zero-energy experiment.

Thus it appeared that the reactor behaviour, in particular the reactor noise, depends strongly on these conditions.

Measurements on the range of fission products in UO_2 were carried out in the zero-energy assembly, leading to figures of

4.5 - 8 μ for the various isotopes. The retention of fission fragments in the fuel particles proved to be higher for a flocculating suspension than for a completely dispersed one.

Activation methods have been used to determine the thermal and epithermal neutron flux distribution inside the core vessel.

It was demonstrated that with a circulating suspension very stable and safe reactor operating conditions can be achieved as well as a time independent distribution of the suspension particles in the reactor vessel together with a constant overall concentration. This holds both for colloid chemically stable and unstable conditions.

Irradiation experiments with fuel suspensions in capsules again emphasized the importance of the colloid chemical properties. In several irradiations no fragmentation was observed unless the system was colloid chemically stable. A tentative explanation of the observed phenomena is presented.

Finally some technological aspects of the KSTR are discussed:

Hydrodynamic considerations and measurements leading to the present design of the core vessel together with the time residence distribution in this vessel.

Erosion phenomena caused by fast or irregularly flowing suspensions.

The applications of specially developed hydrocyclones for the separation of gases or fines from the suspension liquid.